

In re Patent Application of:
COBB ET AL.
Serial No. 09/393,639
Filing Date: September 10, 1999

28 29
36. (New) A communication system according to Claim 36, wherein said receiver is operative to process said QPSK waveform using said extracted carrier signal to derive said data signal.

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37. (New) A communication system according to Claim 37, further including an encoder which is operative to encode said data signal with a forward error correction code, and wherein said receiver is operative to decode the encoded data signal to recover said information from said data signal.

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38. (New) A communication system according to Claim 38, wherein said forward error correction code is one capable of extending error rate performance to a value of E_b/N_0 less than 4 dB.

REMARKS

Applicants again thank the Examiner for his thorough examination of the present application. Independent Claims 9, 17, 23, and 28 have been amended to more clearly define the claims over the prior art. As amended, Claim 9 includes the features formerly recited in Claim 16, which is herein cancelled. Amended Claim 17 includes some of the features formerly recited in Claim 21, which is herein cancelled. Claim 23, as amended, includes some features formerly recited in Claim 26 cancelled herein. Amended Claim 27 includes features formerly found in Claim 8, which is herein cancelled. Claim 28 has been amended to correct a minor typographical error.

Attached hereto is a marked-up version of the changes made to the amended claims by the current amendment. The attached pages are captioned "Version with Markings to

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Show Changes Made."

Claims 29-39 are newly added herewith. Newly added independent Claim 29 combines features of Claim 27 and now-cancelled Claim 6. Newly added independent Claim 35 combines features of Claim 9 and now-cancelled Claim 14.

Support for the amendments and newly added claims may be found, in particular, at pages 9, 15-17, and 21 of the originally filed specification. No new matter is being added.

I. Claims 9, 23 And 27 Are Patentable

The Examiner rejected independent Claims 9, 23, and 27 on the basis of U.S. Patent No. 5,748,623 to Sawahashi et al.

Claim 9 is directed to a communication system that includes a quadrature phase shift keyed (QPSK) waveform generator for generating a QPSK waveform based upon a carrier signal and a data signal, the data signal being representative of information to be transmitted and comprising I and Q components. The QPSK waveform generator biases at least one of the I and Q components with an offset prior to generating the QPSK waveform. The offset comprises a direct current (DC) offset voltage. The communication system further includes a transmitter for transmitting the QPSK waveform produced by the QPSK waveform generator.

An advantage of the DC offset voltage is that it may be applied to encoded data upstream of QPSK modulation circuitry, and thus may serve to shift reference levels for the encoded in-phase data symbol stream values thereby causing the spectral waveform of the QPSK signal to contain a prescribed amount of carrier signal energy. This readily discernible injected carrier obviates the need for a non-linear carrier regeneration circuit in the carrier recovery path of the receiver, as otherwise found in a conventional

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QPSK demodulator. Thus the carrier may be directly extracted by a carrier recovery phase locked loop, for example.

Claim 23 is directed to a method that includes receiving a QPSK waveform having in-phase (I) and quadrature (Q) components of a carrier modulated with I and Q components of a data signal. At least one of the I and Q components of the data signal is biased by an offset that comprises a direct current (DC) offset voltage. The method also includes conducting non-regenerative recovery of the QPSK waveform received in the other step to thereby extract the carrier signal based upon the offset.

Claim 27 is directed to a method of transmitting information. The method includes providing a data signal representative of the information and comprising in-phase (I) and quadrature (Q) components, biasing at least one of the I and Q components with an offset comprising a direct current (DC) offset voltage, generating a QPSK waveform based upon a carrier signal and the at least one biased component, and transmitting the QPSK waveform.

Sawahashi et al. discloses transmitting and receiving QPSK waveforms including providing a data signal having I and Q components. Sawahashi et al. fails, however, to disclose, for example, biasing at least one of the I and Q components with an offset that comprises a fixed direct current (DC) offset voltage. Instead, Sawahashi et al. relies on a frequency offset using a frequency offset circuit. This is in sharp contrast with the direct current (DC) offset voltage recited in Claims 9, 23, and 27, and fails to provide the attendant advantages of a DC offset voltage already noted.

Accordingly, Sawahashi et al. fails to disclose the inventions defined by Claims 9, 23, and 27. In view of the patentability of independent Claims 9, 23, and 27, it is submitted that their dependent claims, which recite yet

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further distinguishing features of the invention, are also patentable. These dependent claims require no further discussion herein.

II. Claim 17 Is Patentable

The Examiner also rejected independent Claim 17 on the basis of Sawahashi et al.

Claim 17 is directed to a method of transmitting information. The method includes providing a carrier signal comprising in-phase (I) and quadrature (Q) components, providing a data signal comprising I and Q components, and biasing the I and Q components of the data signal with at least one offset that comprises a spreading waveform. The method further includes combining the I and Q components of the carrier signal with the biased I and Q components of the data signal, respectively, to produce a QPSK waveform.

As discussed particularly at page 21 of Applicants' specification, biasing the I and Q components of the data signal with at least one offset comprising a spreading waveform may include injecting a spread carrier into the QPSK waveform using a chopped or spread DC offset, for example. The offset may be produced, for example, by controllably gating a +0.k volt offset to a summing unit by means of a randomizing or spreading square wave pattern.

As already noted, Sawahashi et al. discloses transmitting QPSK waveforms including providing a data signal having I and Q components. Sawahashi et al., however, fails to disclose biasing the I and Q components of the data signal with at least one offset that comprises a spreading waveform as recited in amended Claim 17. Accordingly, Sawahashi et al. also fails to disclose the invention defined by Claim 17. In view of the patentability of independent Claim 17, it is submitted that its dependent claims, which recite yet further

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distinguishing features of the invention, are also patentable. These dependent claims require no further discussion herein.

III. Claims 29 and 35 Are Patentable

Newly added independent Claim 29 is directed to a method of transmitting information that includes providing a data signal representative of the information and comprising in-phase (I) and quadrature (Q) components. The method further includes biasing at least one of the I and Q components with an offset comprising a spreading waveform, and generating a QPSK waveform based upon a carrier signal and the at least one biased component. The method also includes transmitting the QPSK waveform.

Newly added independent Claim 35 is directed to a communication system that comprises a QPSK waveform generator for generating a QPSK waveform based upon a carrier signal and a data signal. The communication system also comprises a transmitter for transmitting the QPSK waveform produced by the QPSK waveform generator. The data signal is representative of information to be transmitted and comprises I and Q components, and the QPSK waveform generator biases at least one of the I and Q components with an offset prior to generating the QPSK waveform. The offset comprises a spreading waveform.

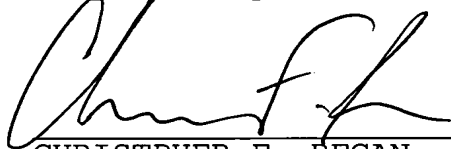
Sawahashi et al., as already noted, fails to disclose biasing the I or Q components of the data signal with at least one offset that comprises a spreading waveform. Accordingly, newly added independent Claims 29 and 35 also define over the prior art. In view of the patentability of independent Claims 29 and 35, it is submitted that their dependent claims, which recite yet further distinguishing features of the invention, are also patentable. These dependent claims require no further discussion herein.

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CONCLUSIONS

In view of the amendments to the claims and the arguments presented above, it is submitted that all of the claims are patentable. Accordingly, a Notice of Allowance is respectfully requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claims 6, 8, 14, 16, 21, and 26 have been canceled.

Claims 9, 17, 23, 27, and 28 have been amended as follows:

9. (Twice Amended) A communication system comprising:

a quadrature phase shift keyed (QPSK) waveform generator for generating a QPSK waveform based upon a carrier signal and a data signal, the data signal being representative of information to be transmitted and comprising I and Q components, and said QPSK waveform generator biasing at least one of the I and Q components with an offset prior to generating the QPSK waveform, the offset comprising a direct current (DC) offset voltage; and

a transmitter for transmitting the QPSK waveform produced by said QPSK waveform generator.

17. (Twice Amended) A method comprising the steps of:

(a) providing a carrier signal comprising in-phase (I) and quadrature (Q) components;

(b) providing a data signal comprising I and Q components and biasing the I and Q components of the data signal with at least one offset comprising a spreading waveform; and

(c) combining the I and Q components of the carrier signal with the biased I and Q components of the data signal, respectively, to produce a quadrature phase shift keyed (QPSK) waveform.

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23. (Twice Amended) A method comprising the steps of:

(a) receiving a quadrature phase shift keyed (QPSK) waveform having in-phase (I) and quadrature (Q) components of a carrier modulated with I and Q components of a data signal, at least one of the I and Q components of the data signal being biased by an offset comprising a direct current (DC) offset voltage; and

(b) conducting non-regenerative recovery of the QPSK waveform received in step (a) to extract said carrier signal based upon the offset.

27. (Amended) A method of transmitting information comprising the steps of:

providing a data signal representative of the information and comprising in-phase (I) and quadrature (Q) components;

biasing at least one of the I and Q components with an offset comprising a direct current (DC) offset;

generating a quadrature phase shift keyed (QPSK) waveform based upon a carrier signal and the at least one biased component; and

transmitting the QPSK waveform.

28. (Amended) A method according to claim 23, wherein the at least one offset comprises a respective offset for each of the I and Q components of the [digital] data signal.

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: DIRECTOR, U.S. PATENT AND TRADEMARK OFFICE, WASHINGTON, D.C. 20231, on this 2nd day of December, 2002.

